other atmospheric conditions, the still larger inquiry was suggested, viz., the sifting and separation of the facts so as to make them disclose the nature and limits of this influence in each particular class of meteorological phenomena. The theory advanced to account for these perturbations was that first suggested by Erman of Berlin, by which they are considered as due to different streams of meteoric matter which are periodically interposed between the earth and the sun—a theory which in view of the facts is open to serious doubt. But the great value of these memoirs lies in their suggestiveness and in the important lines of meteorological inquiry therein pursued and indicated. Indeed the author states that a main object he had in view would be gained if he thereby enlisted the younger meteorologists to aid in establishing clearly in meteorology the notion of periodicity, which in truth is only another name for law and harmony, the evolution of which from facts apparently so entangled and so discordant is the problem presented by meteorology. It may be added here that his two daughters materially assisted him in the laborious calculations for this work. He subsequently wrote various papers on the connection between atmospheric pressure and temperature, on the aurora, and on terrestrial magnetism.

He was one of the founders of the French Meteorological Society, and it was during his term of presidency of the Society that the Meteorological Observatory of Montsouris was established chiefly through his influence and that of M. Dumas, for the special purpose of investigating terrestrial physics, inclusive of the work usually undertaken by meteorological observatories. This observatory remained under his direction from the date of its establishment in June, 1869, to June, 1872, when he was appointed Inspector-General of Meteorological Stations in France. Under his management and that of his successor, Marié Davy, the well-known meteorologist, the Montsouris Observatory has gradually come to occupy, as our readers are doubtless aware, a well-marked sphere of action which we hope similar observatories in other countries will not be slow to adopt. This special sphere of action concerns the application of meteorology to the great national questions of agriculture and public health, particularly the health of large towns; and it consists in a well-devised scheme of chemical and microscopical observations regularly conducted, having for their object the investigation of the composition of the air, more especially as regards the variations of its aqueous vapour, carbonic acid, nitric acid, and ammonia, and its organic and inorganic impurities.

As Inspector-General of the French meteorological stations, he went to Algiers for the purpose of organising the meteorological stations of that country. Owing to the fatigue incident to this journey and the inclement weather he experienced his health was impaired, and it remained in a weak state up to the last. This illness was the more severely felt by a system already enfeebled by a malady which he had contracted thirty-three years before in the service of science. When in 1843 he had just completed his three years' exploration of the volcanic isles of Africa and the Antilles, and it only remained to him to put into shape the rich materials he had collected, the great earthquake, already alluded to, of Pointe-à-Pitre, Guadaloupe, occurred, by which he not only lost the whole of his valuable collections, but was called to mourn the loss of his uncle and several other members of his family, who perished in that catastrophe. The mental suffering and fatigue consequent on these disasters brought on a rheumatic affection, from which he never recovered, and it was to an aggravated form of this malady that he succumbed on October 10, at Paris.

Thus died Charles Sainte-Claire Deville in the midst of his work—a man of singular modesty and amiability of disposition, as well as an enthusiastic worker in science. His funeral was largely attended, but in accordance with a desire expressed in his will, no official deputation of the Academy was present on the occasion, and no funeral oration was pronounced over his grave.

RECENT CAVERN RESEARCHES IN NEW ZEALAND

THE following is the substance of a paper on Cave-Hunting, by Dr. Haast, read at the Philosophical Institute of Canterbury, New Zealand, some time since, and which has been recently forwarded to us.

In the spring of the year 1872, Mr. E. Jollie having suggested to Dr. J. Haast, president of the Institute of Canterbury, that an inspection of the Moa-bone Point Cave, and of the ground near its entrance, would probably help to fix the period of the extinction of the Moas, a subscription list was at once opened, and the results enabled Dr. Haast to commence the work and to carry it on for seven weeks.

Moa-bone Point Cave is situate on the eastern side of the Middle Island, in Banks Peninsula, an extinct volcanic system of large dimensions, which is believed to have been an island in Post-pliocene times, and to have been subsequently raised about 20 feet. The cavern seems to have been a pre-existing hollow in a doleritic lava stream, enlarged by the waves during the insular period. It was well known to Europeans at the very beginning of the Canterbury Settlement, was even inhabited by some of the earliest settlers, of whom ample traces were left behind. Immediately east of the cavern is a small plain, occupied with dunes of drift sand, and bounded seaward by a line of boulders, detached from a small doleritic headland on the western side of the cave when the peninsula was an island.

The entrance to the cavern is from 13 to 14 feet above high water, 30 feet broad and 8 feet high, but is partially occupied by a mass of rock 12 feet long, 6 feet broad, and 10 feet high. This opens into the "First Chamber," which measures, from north to south, 102 feet long, 72 feet broad towards the middle, and about 24 feet high. From its inner or southern end a small passage leads into a "Second Chamber," 18 feet long in a direction N. by W. to S. by E., 14 feet wide, and 11 feet high. At the inner end of this is a passage, 3 feet high, and 2·5 feet broad, leading into a "Third Chamber," measuring 22 feet from N. to S., about 20 feet high, and averaging 16 feet in width.

The floor of the first chamber consisted generally of remains betokening European occupation, but everywhere below them were portions of shells of edible molluscs. These beds gradually thinned out southwards, till at the entrance of the second chamber there was a continuous floor of marine sand.

The explorations appear to have been almost exclusively confined to the first chamber, and to have been commenced by digging two trenches, crossing each other at right angles, near the centre of the chamber. Several other excavations were made, and in one of them, towards the western side of the chamber, the following was the succession of beds, in descending order:—

	ft.	in.
1. European deposits	0	6
2. Shell bed	0	9
3. Tussock and ash beds	0	4
4. Shell beds	1	4
5. Ash beds	0	2
6. Ash beds, mixed greatly with shells	0	10
7. Ash and dirt beds	0	2
8. Agglomeratic bed	0	6
9. Ash bed	0	3
10. Marine sands (excavated to a depth of 7 ft., and found by boring to extend 5 ft. deeper before reaching the rock at the bottom of the cavern)	12	0

Whilst the beds, as might have been anticipated from their characters, were neither equally numerous nor equally thick in different sections, the following important features presented themselves everywhere:—

The basal bed was uniformly the "marine sand" (No. 10); the ash and shell bed (No. 6), the ash and dirt bed (No. 7), and the agglomeratic bed (No. 8), were also well-defined horizons; the shells found in the sixth bed and those above it belonged to species still occupying the adjacent estuary, and the same forms were found in all the beds alike; there were no shells in the seventh bed, or any below it, excepting those which the sea had lodged in the marine sand, some of which were estuarine species, and a very few valves of the common freshwater mussel (*Unio aucklandicus*), found near a "cooking oven" which had been excavated in the same bed; and the sixth and seventh beds were separated by a sharp and constant line of demarcation.

There can be no doubt that, omitting the "European bed," the facts fully justify Dr. Haast's division of the deposits into two distinct series—the "upper," or "shell-bed" series, consisting of the sixth and all the beds above it; and the "lower," of all those below it. The sharp line of demarcation separating the two sets of beds, as already stated, suggested to Dr. Haast that there had been a protracted interval of time between their deposition; and this is strongly supported by the fact that in a section at the entrance of the chamber a bed of drift sand, a foot thick, was found to separate them. It was continuous for some distance southward, but ultimately thinned out in that direction.

The aggregate thickness of the beds of the upper series varied in different sections from one foot to 7·5 feet, being thickest near the entrance, and especially under the shelter of the fallen rock; whilst that of the lower series, exclusive of the marine sand, fluctuated from 8 to 15 inches. The *relative* thickness of the two sets varied considerably in different sections, the lower being but 18 per cent. of the upper at the western end of the cross section in the first excavation, whilst each was one foot thick at the eastern end of the same section. From the data at hand it appears that on the average the thickness of the lower series was about 30 per cent. of that of the higher.

Dr. Haast's "agglomeratic" bed consists of pieces of rock fallen from the roof. Though this fall of fragments was not actually restricted to any one period, inasmuch as all the beds contain lumps and blocks of the kind, it seems to have been peculiarly prevalent during the era represented by the agglomeratic bed.

List of Objects found in the Lower Series of Deposits.

A.—REMAINS OF MAMMALS.

Bones of Man	1
,, Ziphoid Whales	8
,, Sea Leopard (*Stenorynchus leptonyx*)	39
,, Fur Seal (*Arctocephalus lobatus* (?) and *A. cinereus*)	332
,, Small Fur Seal (*Gypsophoca subtropicalis*)	27
,, Dog	43
,, Porpoise	24

B.—REMAINS OF BIRDS.

(*a*) *Extinct Birds* (*Moas*).

Bones of *Dinornis robustus*	13
,, *Palapteryx crassus*	18
,, *Euryapteryx gravis*	35
,, *E. rheides*	94
,, *Meinornis casuarinus*	17
,, *M. didiformis*	103
,, *Aptornis defossor*	1
,, *A. otidiformis*	2
Fragments of bones of different species	51
Tracheal rings of Moas	37
Trays of portions of eggshells of Moas	3

(*b*) *Recent Birds.*

Bones of Spotted Shag (*Graculus punctatus*)	107
,, Black Shag (*G. carbo*)	18
,, Pied Shag (*G. varius*)	15
,, White-throated Shag (*G. brevirostris*)	12
,, Small Blue Penguin (*Eudyptula undina*)	67
,, Grey Duck (*Anas superciliosa*)	17
,, Nelly (*Ossifraga gigantea*)	6
,, Large Kiwi (*Apteryx australis*)	3
,, Kaka (*Nestor meridionalis*)	5
,, Kakapo (*Stringops habroptilus*)	2
,, Tui, Gulls, Terns, and smaller birds	148
Feathers of Kaka	11
,, Nelly	1
,, Spotted Shag	39
,, Harrier (*Circus assimilis*)	1
,, Undetermined	5

C.—REMAINS OF FISHES.

Bones of Hapuku (*Oligorus gigas*)	39

D.—REMAINS OF MOLLUSCS.

Tray of *Unio aucklandicus*	1
,, *Mesodesma cuneata*	1
,, *Mactra discors*	1
,, *Artemis subrosea*	1

E.—OBJECTS OF HUMAN WORKMANSHIP.

(*a*) *In Bone.*

Canine Tooth of Dog, bored at base	1
Needle made of humerus of Nelly	1
Awl ,, tibia ,,	1

(*b*) *In Wood.*

Apparatus for lighting fire, by circular motion, made of Pukatea (*Atherosperma novæ zealandiæ*)	2
Apparatus for lighting fire, by rubbing lengthwise, made of Komaku (*Carpodetes serratus*)	5
Fork, made of Manuka (*Leptospermum scoparium*)	2
Portions of apparatus for lighting fire by rubbing lengthwise, made of Patete (*Melicope ternata*)	1
,, Spear, made of Nene (*Dracophyllum* sp.)	1
,, Pile, made of Totara (*Podocarpus totara*)	2
,, Canoe (?), one made of Tawai (*Fagus menziesii*), one made of Pukatea	2
,, Bird Spear (?) made of Tawa (*Mesodaphne tawa*), a tree of the North Island only	2
Four pieces of Pukatea, and three chips of Totara	7

(*c*) *In Stone.*

Polished adze, perfect	1
,, Implements, fragmentary, one resembling the point of a tool called Tamatau by the Maoris, formerly used by them to make fish-hooks	17
"Cores" of agate, quartz, and chalcedony	4
Chipped flint implements (ten cores, two spearheads, three knives, nineteen flakes)	34
Pieces of gritty sandstone, Taraiwaka of the Maoris, some with grooves for sharpening tools...	4
Four pieces of Obsidian (Tuhua), two of pumice stone	6

In addition to the objects just tabulated, three "cooking ovens" belonging to the lower series of beds were met in the First Chamber. After serving as ovens they were converted into kitchen middens.

Returning to the list of objects of interest: the human bone was a portion of the right ramus of a lower jaw of an individual probably not quite mature. It was found six inches deep in the marine sand, and may have been carried in by the surf, as it lay near the greater portion of the skeleton of a fur seal, which had doubtless been washed in.

The very few valves of the freshwater mussel already mentioned were the only indication that the men of the era of the Lower Series of beds made use of molluscs or their shells. All the other molluscous remains were without doubt washed in by the waves of the sea, and lodged in the marine sand where they were found. The favourite and chief food of the period was obviously the Moa, of which at least eight species belonging to five genera were thus utilised; though, as the table distinctly shows, smaller birds were by no means despised. As no portions of skulls were found, with the exception of very small fragments, it has been inferred that the brain of the Moa was considered a great delicacy. The leg-bones were usually broken, some were calcined, whilst others were in a splendid state of preservation. None of them were gnawed, and even the smallest of them were, without exception, quite intact, except such as had been cut or broken by man; a fact especially noteworthy, as the table shows that there were contemporary dogs. Dr. Haast's earlier researches had led him to the conclusion that the Moa hunters had chased the dog for food, but had not domesticated it. There can be no doubt that this view is considerably strengthened by his recent labours.

There is now satisfactory evidence that the men of the Lower Series used *polished* stone tools as well as such as were merely *chipped.*

The bone needle was 4·25 inches long by ·2 inch broad, and is believed to have been used rather as a bodkin to carry a thread through holes made by the awl. The perforated canine of dog was no doubt worn as an ornament.

Bones of Moas and of other birds presented themselves at very slight depths in the marine sand in the second and third chambers, mixed with ashes and other signs of human occupation.

List of Objects found in the Upper Series of Deposits.

A.—REMAINS OF MAMMALS.

Bones of Man	3
,, Ziphoid Whales	12
,, Porpoise	9
,, Dog	51
,, Sea Leopard	11
,, Fur Seal	37
,, Small Fur Seal	19
,, Rat	3

B.—REMAINS OF BIRDS.

(*a*) *Extinct Birds* (*Moas*).

Small pieces of Moa bones, bleached and decomposed	7

(*b*) *Recent Birds.*

Bones of Spotted Shag	104
,, *Graculus* sp.	17
,, Grey Duck	8
,, Harrier	3
,, White Crane (*Ardea alba*)	2
,, Paradise Duck (*Casarca variegata*)	3
,, Large Kiwi	2
,, Nelly	1
,, Small Birds not yet determined	37
Feathers of Spotted Shag	62
,, Kakapo	49

C.—REMAINS OF FISHES.

Bones of Hapuku	164
,, other Fishes not yet determined	37

D.—REMAINS OF MOLLUSCS.

Tray of Mussel (*Mytilus smaragdinus*), numerous	1
,, Cockle (*Cockle stutchburyi*), numerous	1
,, Pipi (*Mesodesma chemnitzii*), numerous	1
,, *M. cuneata*, numerous	1
,, Periwinkle (*Amphibola avellana*), numerous	1
,, Kokotu (*Lutraria deshayesii*), about thirty lying together	1
,, *Mactra discors*, a few	1
,, *Voluta pacifica*, a few	1
,, *Unio aucklandicus*, a few	1
,, *Haliotis iris*, a few	1

E.—OBJECTS IN WOOD, BONE, OR FIBRE.

Pieces of a Toa, a long thin spear made of Tawa, to shoot birds with. At the upper end a barbed point, called Tara, was fastened, made of human or bird's bone	6
A Manga Oko-oko, a wooden fish-hook, made of Pukatea, with a small piece of whale's tooth, called Mata, standing backwards	1
Patu aruhe, fern-root pounders, four made of Maire (*Santalum cunninghamii*), a strictly Northern Island tree, and one made of Akeake (*Olearia* sp.)	5
Fragments of a Matiha Tuna, fork for spearing eels, made of Manuka	4
Portion of a Kaho, batten for a whare, made of Turepo (*Hoheria populnea*), ribbon wood	1
Portions of several Whaka kai, wooden dishes for preserving fat and juice	13
Taka ore kaka, parrot stands, made of Pukatea	2
Pu-tatara, small trumpet, made of a Struthiolaria shell	2
Mata, mouth of a flax bag, made of twisted thin sticks, for preserving birds after being cooked	1
Taka kai, matting used for covering the food in the hangi, or oven, to keep it clean	2
Parenga-renga, sandals made of flax, or Ti-tree leaves	3
Pawa shells (*Haliotis iris*), in which the holes at the exterior border were filled with flax, for keeping oil	4
Pieces of nets: the floater of pumice-stone is called Poito	4
Matao, fish-hooks, for catching Hapuku, made of Kaikaiatua (*Rhabdothamus solandri*), a Northern Island tree	4
Fish-hook, made of Rata (*Metrosideros*)	1
Piece of timber, of Pukatea	2
Karera, a wooden handle made of Totara, to fasten a piece of greenstone to be used as a chisel	1
Portion of a Patu-patu, a large wooden hammer	1
Tahatiti-whaka, a squared piece of wood (Totara), to fasten the sides of a canoe	1
Puru, made of Manuka, a pin to stop the holes of a canoe for letting water out	2
Kauhuhua, a wooden pin, made of Manuka, to fasten the battens across the canoe	2
Tokai, a thin long stick, used to keep the mouth of the fishing-net open	2
Ripipawa, a knife made of Manuka, to loosen pawa shells	1
Pieces of Matiha, fighting spear, made of Manuka	6
Pieces of timber, portions of mats, cordage, &c.	53
Portion of Korapu, net for catching Inangas or Whitebait	1

F.—OBJECTS IN STONE.

Portions of polished stone implements	3
,, ,, greenstone	1

Among the objects belonging to the era of the beds of the Upper Series, though to a comparatively modern portion of it, was a human skeleton which had been carefully interred. It was detected a few feet from the south-western wall of the First Chamber. The grave had been dug through all the deposits then existing, several feet deep into the underlying marine sand. The body was in a sitting posture, tied together with flax, the face toward the south-west, and it was covered with part of the sand which had been thrown out of the grave; the remainder, as well as the overlying beds which had been dislodged, being thrown around the spot. It was clear that the ground had afterwards been levelled, and that about six inches of shell-bed, level and continuous in all directions beyond the disturbed area, had been subsequently deposited over the grave, whilst over this again lay the European bed, three inches thick. The skeleton is that of a man nearly six feet high, and certainly not young.

It was evident from the accumulations deposited after the interment that the burial had taken place before the arrival of Europeans, and that during the interval the natives continued to frequent the cavern and to take their meals there. The latter fact leads to the inference that its occupation was not constant or even regular, but occasional only and by different tribes; for, judging from the character and superstitions of the existing natives it may be safely concluded that after the burial of one of them the cave would have become strictly *tapu* to all those having any knowledge of the fact, at least so far as taking a meal there is concerned.

On comparing the lists of objects found in the two sets of deposits, the facts which probably most strongly arrest attention are, (1) the presence of Moa bones in the Lower Series, but not in the Upper; and (2) that whilst the upper beds consist very largely of estuarine shells, it may almost be said that in the lower there are no traces of shells introduced by man. When the mind is in addition directed to the condition of the bones of the various species of Moa, as well as to the further fact that the valves of the bivalve shells were almost invariably disunited, there can be no hesitation in accepting Dr. Haast's name of *Moa-hunters* for the men of the Lower Series, and of *shell-fish eaters* for those of the upper. The Spotted Shag and the Dog appear to have been favourite dishes in each period.

The human remains mentioned in the second table were two pelvic bones of a full-grown male, and the ninth dorsal vertebra of a subject not quite mature. As they were all entire, and were the only relics of the human frame found throughout the whole thickness of the beds, Dr. Haast is of opinion that during all the time the shell-fish eaters were in possession of the ground they were either not addicted to cannibalism, or their relations with neighbouring tribes were of so peaceful a character as to afford them no opportunity to indulge in that horrible practice. Looking, however, at the great lapse of time represented by the shell accumulations, and the insecurity of life amongst savage tribes, he believes that had they been cannibals when, at least, the lower shell beds were formed, there would have been some evidence of the fact.

Excepting the Fur Seal (*Arctocephalus lobatus*) as of doubtful identification, the two lists of mammals differ only in the occurrence of the rat in the shell beds, where, however, there were but three of its bones. Its presence was further attested by its teeth-marks on many of the bones, and by its holes passing through the upper beds. A few of the bones had been gnawed by dogs, whence it may perhaps be inferred that the shell-fish eaters had effected its domestication.

Dr. Haast supplements the description of his cavern researches with a brief account of his labours amongst the sand dunes in the adjacent plain. Numerous cooking ovens occurred amongst them, where they were often close together, and, like those in the cavern, appear to have been ultimately filled more or less with the refuse of feasts. A clear line of demarcation was found here also between the deposits of the Moa-hunters and those of the shell-fish feeders, and, except in one instance, where a few pieces of the fresh-water mussel were met with, no shells occurred in the older series of deposits. Judging from the greater number and volume of the kitchen middens found in the small area examined, there can be no doubt that the real camping ground of the Moa-hunters was on the plain, and that they used the cavern occasionally only for shelter or for their meals, and very rarely for cooking. It seems most in accordance with the facts, also, to suppose that the shell-fish eaters lighted fires in the cavern for warmth and light, and that they probably slept there, but that, like their predecessors, they cooked their food outside.

Dr. Haast gives a tabular list of the objects collected in the Moa-hunters' middens amongst the dunes, but it is to a very large extent a repetition of the contemporary cavern list.

Dr. Haast is of opinion that the time represented by the cavern deposits was very great, and, in support of his view, directs attention to the following facts and considerations:—

1. That the mere volume of the shell-beds alone must have a great chronological value, on any hypothesis.

2. That this value is greatly enhanced by the fact of the cavern being but occasionally occupied.

3. That even the occasional visits were probably suspended during a considerable interval after the interment of the Maori.

4. That on the inner or westerly portion of the adjacent plain there is a remarkable number of shell heaps, belonging to the era of the upper series of deposits, which the natives attribute generally to the Waitaha, the first immigrants, who preceded the Ngatimamoe, who in their turn preceded the Ngatikuri, the present inhabitants.

5. That though the cannibalism found in New Zealand when first discovered by Europeans had been practised for at least several centuries, there is an almost entire absence of human bones even in the shell beds, whilst the three solitary specimens of this kind which were met with were so entire and perfect as to negative the idea that the men of even that comparatively modern period were cannibals; and that the same view is borne out by a study of the Moa beds.

6. That as far back as the traditions of the Maoris go, allusion is made in their songs to the Weka (*Ocydromus australis*); yet amongst the hundreds of bones belonging to small birds, not a vestige of the Weka was met with in any of the deposits.

7. That beyond the vast period covered by the shell beds was that interval represented only by the uniform sharp line of demarcation between the two sets of deposits, by the intermediate layer of drift sand, by the disappearance of at least eight species of Moas, and by the strongly marked change in the food of the natives.

8. That since the extinction of the Dinornis and its contemporaries there has been a period sufficiently considerable for the conversion of an area then occupied with large lagoon-like lakes into that part of the Canterbury Plain which is now near the sea, and for the formation of sand dunes of great width upon it.

9. That further back still was the period of the Moa-hunters, to whose deposits, due allowance being made for their somewhat smaller volume, all the considerations applied to the beds above them may be repeated with equal force.

There seems reason to believe that the civilisation of the Moa-hunters was in many respects not inferior to that possessed by the Māoris when first visited by Europeans.

It is obvious that if the entire absence of Moa remains in the shell-beds of the cavern and the adjacent dunes is to be regarded as conclusive on the point, there can be no reason for hesitating to accept the opinion that an enormous amount of time must have elapsed since the extinction of the gigantic birds in at least that portion of the island.

In more recent papers, Dr. Haast expresses the belief that subsequent researches, in other parts of New Zealand, tend to confirm his conclusions.

THE GERMAN EXPEDITION TO SIBERIA[1]

THE travellers left Saissan on May 31, and arrived in Maiterek on June 4, in the company of his excellency the governor-general of West Siberia, General Pottaratzki, whom they met two nights previous to their arrival. Three tarantassas drawn by artillery horses conveyed them from Saissan on to the shores of the black Irtisch. Their way led again through the steppe mostly covered with Dschi, a kind of short, thick grass, with here and there patches of white alkaline soil; but after some time their eyes were refreshed by the appearance of a few trees, their number increased until the country became wooded, and therefore they hoped soon to reach the river. In the evening they saw before them the banks of the stream, swelled by the recent rain into a majestic river, its waters of a yellowish brown colour. For 200 versts into China the stream is navigable for steamers, but up to this time it is not used as a means of communication. Beautiful trees bordered the river, and it was a pleasant change for the travellers, who had seen no trees since the Ala Tau, to find magnificent poplars, asps, and many other trees and bushes. Though the steppe is grand yet it becomes tedious after a while. The travellers continued their journey in a lotka (a sort of boat) belonging to a rich Kirghiz, who is one of the fishers of the Saissan Nor (Saissan Lake). The lotka was propelled by two enormous oars worked in turn by eight Kirghiz or eight Cossacks. The journey down the Irtisch was rendered delightful by the beautiful vegetation near its banks, and the abundance of birds made it a perfect eldorado for the naturalist. They were tempted to stay here, but "heida" (Kirghisian for "on") was the call, which they had to obey. Gradually the strength and width of the river decline as it gets narrowed in by dense masses of reeds. In the evening they reached the settlements of some fishermen, resembling those seen in Norway—here as there frames for drying the fish, here as there the same disagreeable smell, so attractive for the black Milans, of which they shot a specimen of the Indian variety. A quantity of fish was caught, amongst them splendid specimens of a kind of Coregonus, carp, barbel, and sturgeon, the roe of which is prepared as caviare. Towards evening they landed amidst dense reeds.

Early on June 2 an excursion to the neighbouring lake was made. On the banks were a good many persons fishing, and numbers of birds—amongst them the East Indian kind of the bald eagle (*Haliætus leucoryphus*), sitting in pairs on the trunks of dead trees—were animating the shores of the river and the reeds. About half-past seven—sunset—they landed; Kirghiz with camels and horses were awaiting them, and they proceeded on their journey over the most desolate steppe imaginable towards the north. This steppe was very stony and sparsely covered with vegetation; only at the outskirts the crippled brushwood of the Saik-Saul, of a myrtle-like appearance, was to be found; further on nothing but bare gravel; eye-witnesses told the travellers that the appearance of this steppe was quite analogous to that of the desert of Gobi. For seven hours' march there was no water, although in spring this steppe is quite impracticable as the water then flowing down the mountains forms ponds and swamps in the loamy parts. Often they passed the dry beds of such ponds, looking like mosaic by reason of the frequent and regular cracks in the dry mud. Here the spermophilus was met with for the first time, and later on three kulans, the wild solipede of these parts of Asia (more horse than ass), accompanied by a young one. Never were the mirages seen more beautiful than on this steppe, though occurring every day, here were splendid blue lakes with trees on the shores so distinctly that they could fancy them to be real. Several other times Saiga antelopes were seen and kulans, once seven at a time, but none were obtained. At last they came to a depression and found a bad but welcome spring; they rested here for a few hours. On proceeding they had soon to pass through a hilly country covered with slate. This part was interesting for the geologist: granite followed immediately upon slate, then slate and granite, after this quartz, white and grey, and with this a coarse-grained sandstone. On June 4 they reached the outlyers of the Altai; here they saw a numerous fauna and many settlements of the Kirghiz with their cattle. The outlyers consist of granite, crystallised slate and a hornblend porphyry, they are fantastically shaped but quite bare, yet not without some picturesque beauty. The zigzag road led up hill. At last they saw in the distance a lovely valley with green trees, and with the joyous cry of "Maiterek" the Kirghisian guide galloped downward, followed as fast as possible by the others, to a yurt camp, situated in a wood of aspen trees near a murmuring rivulet. This was the place where the governor-general was expected, and at last, accompanied by many Kirghiz, his excellency the governor arrived with a large escort, including ladies. A friendly welcome was exchanged, and

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[1] Abstract of the third and fourth letters dated from Maiterek, June 5, and a valley in the Tau Teke Mountains, in the Chinese Altai, June 11, respectively. Continued from p. 515.